

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



10/521659

(43) International Publication Date
29 January 2004 (29.01.2004)

PCT

(10) International Publication Number
WO 2004/010352 A1

(51) International Patent Classification⁷: **G06F 17/60**,
H04N 7/173, G06F 17/30

Alphons, A., M., L. [NL/NL]; c/o Prof. Holstlaan 6,
NL-5656 AA Eindhoven (NL).

(21) International Application Number:
PCT/IB2003/003015

(74) Agent: **SCHMITZ, Herman, J., R.**; Internationaal Oc-
trooibureau B.V., Prof. Holstlaan 6, NL-5656 AA Eind-
hoven (NL).

(22) International Filing Date: 1 July 2003 (01.07.2003)

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD,
SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US,
UZ, VC, VN, YU, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
02077983.1 22 July 2002 (22.07.2002) EP

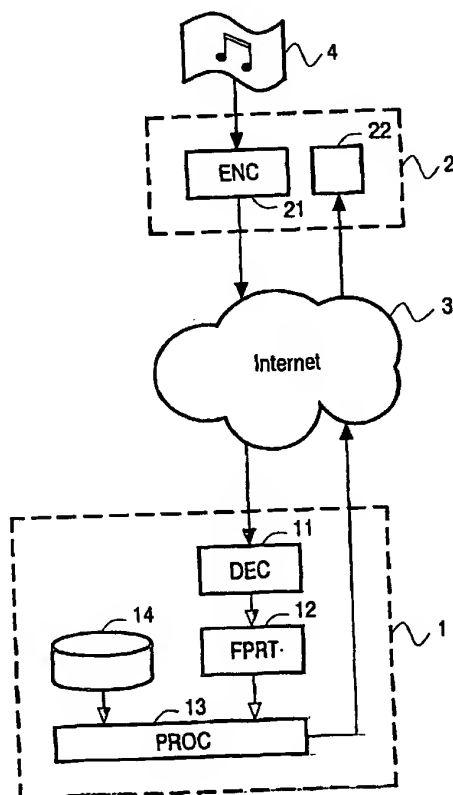
(71) Applicant (*for all designated States except US*): **KONIN-
KLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL];
Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,

(72) Inventor; and
(75) Inventor/Applicant (*for US only*): **BRUEKERS,**

[Continued on next page]

(54) Title: DETERMINING TYPE OF SIGNAL ENCODER



(57) Abstract: In order to promote its "xxx" signal encoding algorithm, company X offers users of a particular encoder (21) the possibility to upload (parts of) their .xxx files to the company's website. The company's web-server (1) checks whether the received file is indeed xxx-encoded material by (i) decoding the file using an xxx-decoder (11), (ii) deriving a fingerprint (12) from the decoded signal, and (iii) awarding the owner if the derived fingerprint corresponds to one of the fingerprints stored in X's database (14). A possible award is the transmission, to the user, of metadata associated with the signal such as title, artist, lyrics, etc.

WO 2004/010352 A1



SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM,

KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Determining type of signal encoder

FIELD OF THE INVENTION

The invention relates to a method of determining whether an encoded signal has been encoded with a particular type of encoder. The invention also relates to a server station being arranged to carry out such a method.

5

BACKGROUND OF THE INVENTION

Numerous types of encoding algorithms are nowadays used to encode multimedia files. Well known compression formats are "zip" (for data), "mp3", "wma" (for audio), "avi" and "divx" (for movies). The respective encoder removes almost all redundancy, and in case of lossy encoding also the irrelevancy, from the original signal so as to obtain an encoded signal that can more efficiently be stored and/or distributed.

Sometimes it is desired to determine by which type of encoder an encoded signal has been produced, or at least ascertain whether an encoded signal has been produced by a particular type of encoder. Computer file names have an extension (such as .zip, .mp3, .avi) for that purpose. Some encoders also render identification possible by adding a header that reveals the necessary information to the contents. However, file name extensions and headers are sometimes missing or cannot be trusted.

15

Generally, the type of encoding cannot be identified by mere inspection of the encoded signal, because the encoded and compressed contents contain little or no structure. A trivial solution would be to try all possible decoders and interpret their outputs. For audio signals, a human being would have to listen whether the decoder output is music or not. This may be a hard decision for some types of music. Moreover, such a solution requires human interaction and cannot be automated.

20

25 OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to provide an alternative method and arrangement for determining whether an encoded signal has been encoded with a particular type of encoder.

These and other objects are achieved with the method in accordance with the invention, which method comprises the steps of: receiving at least a part of said encoded signal; decoding the received signal using a decoder which performs the reverse operation of said particular type of encoder; deriving a fingerprint from the decoded signal; comparing said fingerprint with fingerprints stored in a database; and concluding that the encoded signal has been encoded with said particular type of encoder if the derived fingerprint corresponds to one of the fingerprints stored in the database.

The invention exploits the insight that the structure of encoded material is meaningless to a decoder which is not complementary to the respective encoder. Contents being decoded by the wrong decoder differ significantly from the original contents. It is even unlikely that music or video being reproduced by a wrong decoder resembles any other existing original material. Fingerprints are binary sequences that identify robust perceptual features of contents. If two signals are similar, their respective fingerprints are also similar. If two signals are perceptually different, the respective fingerprints are also different. This property of fingerprints is used by the method in accordance with the invention to determine whether the decoded signal is an original one.

An advantageous application of this method is promotion of a particular signal encoder. In order to promote its "xxx" signal encoding algorithm, company X offers owners of its xxx-encoder the possibility to upload (parts of) their .xxx files to the company's website. Using the method according to the invention, the company's web-server checks whether the received file is indeed xxx-encoded material and in the affirmative case awards the owner. A possible award is the transmission, to the user, of metadata associated with the signal such as title, artist, lyrics, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects of the invention are apparent from and will be elucidated with reference to the embodiment shown in the drawings, in which:

Fig. 1 shows a schematic diagram of a system to illustrate the operation of the method in accordance with the invention.

DESCRIPTION OF EMBODIMENTS

The invention will be explained with reference to audio signals, but it will be appreciated that the invention is not limited thereto and can equally be applied to video and other types of multimedia signals. Fig. 1 shows a schematic diagram of a system to illustrate

the operation of the method in accordance with the invention. The system comprises a server 1 and a client 2 connected together through a network 3.

The client 2, which may in practice take the form of a personal computer, comprises an audio encoder 21 and a return channel input unit 22. The audio encoder may be a software program being downloaded from the server 1. A piece of music 4 being applied to the client is encoded by audio encoder 21. The encoded audio signal is subsequently uploaded to the server 1 through the network.

The server 1 comprises an audio decoder 11, a fingerprint extraction unit 12, a processor 13, and a database 14. In the server, the song being uploaded by the client is decoded by the audio decoder 11. If the encoder 21 being used by the client matches the server's decoder 11, then the decoded signal will be the same as, or at least perceptually resemble, the original piece of music 4. Otherwise, the decoded audio signal will be an undefined creaky noisy sound, because the encoded signal has a structure which is meaningless to a decoder which has not been designed to be the complement of encoder 11.

The decoded audio signal is applied to the fingerprint extraction unit 12. A fingerprint is a bit pattern indicative of robust perceptual features of the audio signal. If two audio signals are perceptually very similar, the respective fingerprints are also similar (but not necessarily identical). A practical embodiment of the fingerprint extraction unit 12 that can be used in the system is described in Jaap Haitsma, Ton Kalker and Job Oostveen, "Robust Audio Hashing for Content Identification", CBMI 2001, Brescia, Italy. For video applications, a practical embodiment is described in Job Oostveen, Ton Kalker and Jaap Haitsma, "Visual Hashing of Digital Video: Applications and Techniques", SPIE, Applications of Digital Image Processing XXIV, July 31 - August 3 2001, San Diego, USA.

The fingerprint extracted from the decoded audio signal is searched in the database 14 by the processor 13. In the database, one or more fingerprints are stored, which have previously been extracted from respective original audio signals. If the extracted fingerprint matches one of the fingerprints stored in the database, then the decoder 11 has apparently indeed decoded an original piece of music. In that case, the processor concludes that encoder 21 of client 2 is indeed the counterpart of the server's decoder 11. An appropriate message is then sent to the client.

If the extracted fingerprint is not found in the database, then either the encoder 21 being used by the client is not the counterpart of decoder 11, or the uploaded piece of music 4 is not stored in the server's database. In the latter case, the server may transmit a

message to the client requesting him to upload a particular song or one from a plurality of particular songs.

In a practical embodiment of server 1, the decoding 11, fingerprint extraction 12, and database searching are all performed by the processor 13, which to that end is loaded with an appropriate computer program.

A novel application of this invention is promotion of a particular signal encoder. A company may encourage the public to buy its encoder by awarding the owner for uploading a piece of encoded material to its website. After identifying the origin of the uploaded signal as being encoded by the preferred encoder, the owner can be given rights to access particular information or execute particular processes.

The invention can be summarized as follows. In order to promote its "xxx" signal encoding algorithm, company X offers users of a particular encoder (21) the possibility to upload (parts of) their .xxx files to the company's website. The company's web-server (1) checks whether the received file is indeed xxx-encoded material by (i) decoding the file using an xxx-decoder (11), (ii) deriving a fingerprint (12) from the decoded signal, and (iii) awarding the owner if the derived fingerprint corresponds to one of the fingerprints stored in X's database (14). A possible award is the transmission, to the user, of metadata associated with the signal such as title, artist, lyrics, etc.

CLAIMS:

1. A method of determining whether an encoded signal (4) has been encoded with a particular type of encoder (21), the method comprising the steps of:
 - receiving at least a part of said encoded signal;
 - decoding (11) the received signal using a decoder which performs the reverse operation of said particular type of encoder;
 - deriving a fingerprint (12) from the decoded signal;
 - comparing (13) said fingerprint with fingerprints stored in a database (14); and
 - concluding that the encoded signal has been encoded with said particular type of encoder if the derived fingerprint corresponds to one of the fingerprints stored in the database.
2. A method as claimed in claim 1, wherein said steps are performed by a server (1) which receives the encoded signal from a client (2) through a network (3).
3. A method as claimed in claim 2, further comprising the step of awarding (22) the client if the server concluded that the received encoded signal has been encoded with said particular type of encoder.
4. A method as claimed in claim 3, wherein said step of awarding comprises retrieving from the database metadata associated with the signal, and transmitting said metadata to the client.
5. A server station (1) connected to a network (3) for receiving encoded signals from a client (2), the server station comprising:
 - a database (14) for storing one or more fingerprints identifying respective multimedia signals (4);
 - a decoder (11) for decoding an encoded signal received from said client, the decoder performing the reverse operation of a particular type of encoder (21);
 - means (12) for deriving a fingerprint from the decoded signal;

- processing means (13) for comparing said fingerprint derived from the decoded signal with fingerprints stored in said database, and concluding that the received encoded signal has been encoded with said particular type of encoder if the derived fingerprint corresponds to one of the fingerprints stored in the database.

5 6. A server station as claimed in claim 5, further comprising means for awarding the client if the server concludes that the received encoded signal has been encoded with said particular type of encoder.

10 7. A server station as claimed in claim 6, wherein said awarding comprises retrieving from the database metadata associated with the signal, and transmitting said metadata to the client.

8. A computer program product for instructing a processor (13) to carry out the method as claimed in any one of claims 1 to 4.

1/1

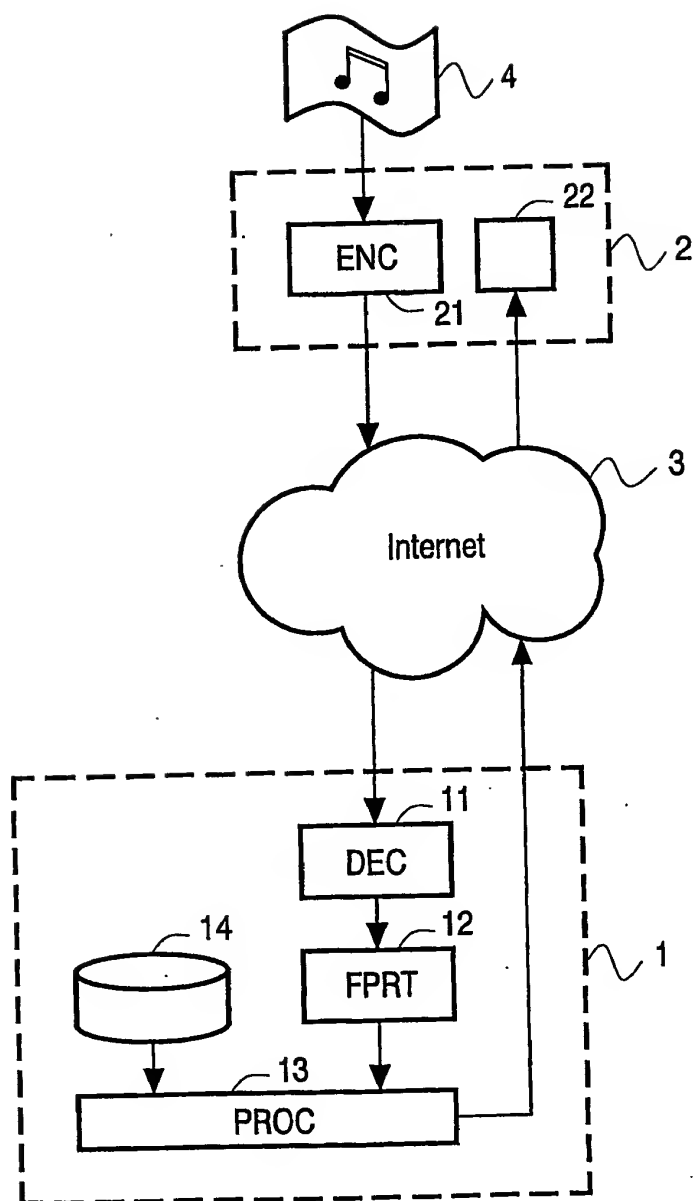


Fig.1

INTERNATIONAL SEARCH REPORT

B 03/03015

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F17/60 H04N7/173 G06F17/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F H04N H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, COMPENDEX, IBM-TDB, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 210 820 A (KENYON STEPHEN C) 11 May 1993 (1993-05-11) column 1, line 5 - line 13 column 4, line 33 - line 61 column 14, line 64 - column 15, line 4	1,2,5,8
A	HAMPAPUR ET AL: "Feature Based Indexing for Media Tracking" IEEE INTERNATIONAL CONFERENCE ON MULTIMEDIA AND EXPO, XX, XX, 30 July 2000 (2000-07-30), pages 1709-1712, XP002198246 paragraph '0001! paragraph '06.1! --- -/-	1,5

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

Date of the actual completion of the international search

17 October 2003

Date of mailing of the international search report

24/10/2003

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Ogor, M

INTERNATIONAL SEARCH REPORT

B 03/03015

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 02 27600 A (SHAZAM ENTERTAINMENT LTD ;BARTON CHRISTOPHER JACQUES PEN (US); WAN) 4 April 2002 (2002-04-04) the whole document ---	1-8
A	US 6 175 590 B1 (STEIN JEREMY M) 16 January 2001 (2001-01-16) abstract ---	1
A	GB 2 295 699 A (I IRELAND LIMITED SA) 5 June 1996 (1996-06-05) the whole document ---	1,2,5
P,A	WO 02 097603 A (RITZ EDOUARD ;THOMSON LICENSING SA (FR)) 5 December 2002 (2002-12-05) the whole document -----	1,2,5,8

INTERNATIONAL SEARCH REPORT

B 03/03015

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5210820	A	11-05-1993	AT 142815 T CA 2041754 A1 DE 69122017 D1 DE 69122017 T2 EP 0480010 A1 ES 2091328 T3 HK 133697 A JP 5501166 T JP 3130926 B2 WO 9117540 A1	15-09-1996 03-11-1991 17-10-1996 10-04-1997 15-04-1992 01-11-1996 24-10-1997 04-03-1993 31-01-2001 14-11-1991
WO 0227600	A	04-04-2002	AU 9298201 A WO 0227600 A2	08-04-2002 04-04-2002
US 6175590	B1	16-01-2001	AU 8698698 A CN 1266577 T EP 1010305 A1 JP 2001513598 T TW 453081 B WO 9908425 A1 ZA 9807149 A	01-03-1999 13-09-2000 21-06-2000 04-09-2001 01-09-2001 18-02-1999 09-02-1999
GB 2295699	A	05-06-1996	BE 1007202 A6	18-04-1995
WO 02097603	A	05-12-2002	WO 02097603 A1	05-12-2002